CALIFORNIA MARINE LIFE PROTECTION ACT INITIATIVE: PRELIMINARY DRAFT MASTER PLAN FRAMEWORK

CONTENTS

Executive Summary

[To be prepared upon the completion of a draft master plan framework.]

Section 1. Introduction

The rich natural heritage of California has supported commercial and recreational fisheries, which have provided consumers with a healthy source of high-quality protein, recreational anglers with a unique experience, and many coastal communities with sources of employment and revenues. California's nearshore waters have become among the top destinations for sport divers from around the world. Whether watching the flight of birds or the graceful forms of dolphins and whales, Californians also have increasingly sought enjoyment from observing marine wildlife. The dramatic growth of marine aquaria along the coast also serves as evidence of growing public interest in ocean wildlife, while California's century-long renown as a leader in marine science has only grown. California enjoys beautiful and productive marine resources.

In 1999, the State of California adopted the Marine Life Protection Act (MLPA), one in a long history of statutes and regulations designed to protect California's ocean and estuarine waters and the species and habitats found within them (FGC Section 2851-2863). The Department of Fish and Game is required to prepare and present to the Fish & Game Commission a Master Plan that will guide the adoption and implementation of the Marine Life Protection Program (FGC Section 2855[b]1). The Commission is required to adopt a master plan, based on the best readily available science, which includes recommendations for a statewide network of marine protected areas (FGC Section 2855[a]).

Another important law, the Marine Managed Areas Improvement Act (Public Resources Code, Sections 10900 et seq.), was adopted in 1998. The two measures, taken together, represent a very strong state policy declaration that California intends to protect its oceans and the marine species that live there.

Adding extra significance, on October 18, 2004, Governor Arnold Schwarzenegger announced an Ocean Action Plan (citation). One part of this Action Plan is the work of the MLPA Blue Ribbon Task Force and full implementation of the MLPA. These are but the latest in California's growing efforts to ensure protection and long-term conservation, use, and enjoyment of its living marine resources.

Early Years

From its very first days as a state in 1850, California has adopted statutes and regulations dealing with the ocean, fisheries, and protection of resources, commerce and industry. In an historic sense, California's history of involvement (as with most other states) has been through early steps to regulate fishing and define health and safety requirements for those who earn a living on the waters, to protection and preservation of unique areas and features along the California coastline and in state waters. The third bill adopted in the First Session of the California Legislature recognized and regulated the Bay Pilots, the professionals who to this day, guide commercial ships into San Francisco Bay.

In the early decades of statehood, California's policy toward natural resources reflected the desire of government at all levels to promote economic expansion by bringing natural resources into production (McEvoy 1986). Even so, lawmakers in California, as elsewhere, began becoming concerned that the

expansion of fishing might well threaten the long-term economic health of the fishing industry. In 1852, the Legislature passed its first fishing statute to regulate the Sacramento River salmon fishery, and continued to do so over the next several decades. In 1870, the Legislature responded to the concerns of sport fishermen by establishing a State Board of Fish Commissioners, which later became today's Fish and Game Commission. In this, and other ways, California led the nation. By the end of the 19th century, the California Legislature had adopted a body of fisheries management law that was a model for its time.

At the same time, the courts repeatedly upheld the importance of the state's role in protecting its resources. In 1894, for instance, the California State Supreme Court found as follows: "The wild game within a state belongs to the people in their collective, sovereign capacity; it is not the subject of private ownership, except in so far as the people may elect to make it so; and they may, if they see fit, absolutely prohibit the taking of it, or any traffic or commerce in it, if deemed necessary for its protection or preservation, or the public good."

Californians who fish often feel strongly about both available fisheries and regulations on access. Some assert that Article 1, Section 25, of the California Constitution seems to give the public a "right to fish." It states "The people shall have the right to fish upon and from the public lands of the State and in the waters thereof…provided, that the legislature may by statute, provide for the season when and the conditions under which the different species of fish may be taken." It is the second half of this statement that makes it clear that this "right to fish" is not absolute. In 1918, the California Supreme Court considered whether a law providing for the licensing of fishermen was unconstitutional because it violated Article 1, Section 25. The court rejected the argument, finding that the provision authorizing the Legislature to fix the seasons and conditions under which fish are taken was intended to leave the matter in the Legislature's discretion. As recently as 1995, a court reaffirmed the express authorization of fishing regulation by the Legislature created only a qualified, not fundamental, right to fish and was not intended to curtail the ability of the Legislature (or the Commission through Legislated authority) to regulate fishing.

Like other economic activities, from agriculture to manufacturing, fishing began expanding rapidly in the first few decades of the 1900s. In 1912, the Legislature respond by authorizing staff for the California Fish and Game Commission, which found itself with greater and greater responsibilities for managing industrial fisheries, in particular. In 1927, the Legislature responded to growing fishing pressures by creating a Department of Natural Resources, within which it housed a Division of Fish and Game. Over the coming decades, California state agencies and universities became leaders in the relatively new field of marine fisheries research and management. In 1945, the Legislature granted the Commission discretionary authority over recreational fisheries. In 1947, the Legislature responded to the collapse of the commercial sardine fishery by instituting a tax on sardine landings that was used to fund research into causes for the decline. These activities led to the inauguration of one of the world's longest series of fisheries research cruises: the California Cooperative Oceanic Fisheries Investigations CalCOFI, a cooperative venture of the California Department of Fish and Game, Scripps Institution of Oceanography, and the National Marine Fisheries Service.

Post World War II

After World War II, the marine policies of California and other state and federal governments were based largely on several assumptions that reflected the progressive thinking of the time. First, the abundance of marine wildlife was thought to be nearly without practical limits. Second, scientists and fishery managers believed that we possessed enough knowledge to exploit marine populations at very high levels over long periods of time without jeopardizing them. Third, the value of marine wildlife was principally as a commodity to be processed and traded. Finally, the chief challenge in fisheries management was to expand domestic fishing fleets in order to exploit the assumed riches of the sea.

In the face of disturbing declines in a number of fisheries, state and federal fisheries agencies around the country began an intensive review of prevailing policies in the mid-1960s. In 1967, the California Legislature passed the California Marine Resources Conservation and Development Act to develop a long-range plan for conservation and development of marine and coastal resources (1967 California Statutes Ch. 1,642). In the same year, Governor Ronald Reagan imposed an emergency two-year moratorium on sardine fishing (1967 California Statues Ch. 278).

Beginning in the 1970s, views slowly shifted. Marine wildlife and ecosystems were increasingly valued for themselves and for uses such as tourism, education, and scientific research. Recognition has been growing of the need to balance the fishing capacity of fleets with the often limited and uncertain productive capacity of marine wildlife populations. Rather than seeking to extract only the maximum yield from marine wildlife populations, fisheries managers began seeking levels that are likely to be ecologically and economically sustainable into the distant future.

California's Marine Heritage

For 1,100 miles, the spectacular mass of California's lands meets the Pacific Ocean. In many areas, mountains plunge into the oceans. Elsewhere, ancient shorelines stand as terraces above the surf. Streams and rivers break through the coastal mountains and, in some places, flow into bays and lagoons rimmed with wetlands. Offshore, islands and rocks break the surface.

This is what we can easily see. But beneath the surface of the water offshore, California's dramatic geological formations continue. Unlike the Atlantic or Gulf coasts, California's shallow continental shelf is quite narrow, generally no wider than five miles. At its broadest point off San Francisco, the shelf extends 30 miles offshore before plunging from 600 feet to the abyssal region at 6,000 feet. Beyond state waters, peaks called seamounts rise from the depths to the photic zone where sunlight spurs plant growth and attracts life.

Whether near or far from shore, the ocean bottom may be rocky, sandy, or silty. It may be flat or formed of rocky reefs. In many areas along the coast, great canyons cut into the continental shelf quite close to shore. For example, the Monterey submarine canyon, which is larger than the Grand Canyon of the Colorado, begins within miles of the shoreline. There, as in other submarine canyons, marine life normally found far offshore is drawn close to land by the deep waters. Off southern California, the ocean bottom appears like a piece of crumpled paper, with basins, troughs, canyons, peaks, and cliffs alternating in a checkerboard pattern.

Ocean currents introduce other dimensions to California's coastal waters. For much of the year, the California Current brings colder northern waters southward along the shore as far as southern California. There, where the coastline juts eastward, the California Current moves offshore. In the gap between the California Current and the mainland, the Southern California Countercurrent flows into the Santa Barbara Channel. Around Point Conception, these two currents meet, creating a rich transition zone. Closer to shore and deeper, the California Undercurrent also carries warmer water northward.

Seasonal changes in wind direction commonly create seasonal patterns for these currents. In March, for instance, northwesterly winds combine with the rotation of the Earth to drive surface waters offshore, triggering the upwelling of cold, nutrient-rich water from the depths. Fueled by sunlight and the nutrients, single-celled algae bloom and create a rich soup that fuels a blossoming of marine life, attracting larger animals from seabirds and swordfish to humpback and blue whales.

By September, as the northwesterly winds die down, the cold water sinks again and warmer waters return to the coast. This oceanic period lasts into October, when the predominant winds move to the southwesterly direction. These winds drive a surface current, called the Davidson Current, which flows north of Point Conception and inside the California Current, generally lasting through February.

Laid over this general pattern are both short-term and long-term changes. Local winds, topography, tidal motions, and discharge from rivers create their own currents in nearshore waters. Less frequently, a massive change in atmospheric pressure off Australia floods the eastern Pacific with warm water, which suppresses the normal pattern of upwelling. These short-term climatic changes, called El Niño, reduce the productivity of coastal waters, causing some fisheries and seabird and marine mammal populations to decline. El Niños can also increase the abundance of other species. For instance, warm waters that flow north in an El Niño carry the larva of sheephead and lobster from the heart of their geographical range in Mexico into the waters off California.

Other oceanographic changes last for a decade or more. In these regime shifts, water temperatures rise or fall significantly, causing dramatic changes in the distribution and abundance of marine life. The collapse of the California sardine fishery occurred when heavy fishing continued on sardine populations that were greatly reduced by a cooling of offshore waters in the late 1940s and early 1950s. In response to the decline in sardines, California law severely curtailed the catch. In 1977, waters off California began warming and remained relatively warm. The warmer water temperatures were favorable for sardines, whose abundance greatly increased. But the warmer waters also reduced the productivity of other fish, including many rockfishes, lingcod, sablefish, and those flatfishes that favor cold water for successful reproduction.

Currents and other bodies of water may differ dramatically in temperature and chemistry, as well as speed and direction. These factors all influence the kinds of marine life found in different bodies of water. In general terms, geography, oceanography, and biology combine to divide California marine fisheries and other marine life into two major regions north and south of Point Conception. Within each region, other differences emerge. Conservation and use of California's marine life depends partly upon recognizing these differences.

Marine Life of California

The waters off California are host to hundreds of species of fish. Thousands of species of marine invertebrates inhabit the sea floor from tidepools along the shoreline to muddy plains 8,000 feet deep. Dozens of species of coastal and offshore birds spend some part of the year in California's waters, as do 35 species of marine mammals.

This great variety of marine life reflects the different responses of groups of animals and plants to changing environmental conditions over long periods of time. In successfully meeting their needs for growth, survival, and reproduction, individual species have developed a set of characteristics that biologists call life history traits. These traits include age at maturity, maximum age, maximum size, growth rate, natural mortality, and feeding and reproductive strategies.

Differences among species can be dramatic. For instance, California market squid mature within 12 months and die soon after spawning, whereas widow rockfish do not mature until age five at the earliest and may live as long as 59 years. This has profound consequences for managing fisheries so that they are sustainable.

Reproductive strategies also vary. Queenfish, for instance, may spawn 24 times in a season, releasing their body weight in eggs into the open water, where most will be eaten whether or not they are fertilized. In contrast, species such as olive rockfish spawn just once a year, releasing up to 500,000 larvae, which have been fertilized and developed internally. Other species, including sharks and surfperches, bear a small number of fully functional and live young each year.

Amid the variety, the life histories of fish tend to fall into several larger categories. For instance, fish species that have low rates of mortality as adults, such as many species of sharks, bluefin tuna, and billfish, also mature late and reproduce in smaller numbers. Organisms that have high rates of mortality as adults, such as anchovies and squid, grow quickly, mature early, and reproduce in large numbers. Some species spend the first several months of their lives floating as planktonic larvae in ocean currents. Climate and oceanographic changes influence the abundance of these species more than does the number of spawning adults.

Species differ also in their movements. For instance, during winter Dover sole move into deep water where they reproduce, then move into shallow water in the summer to feed. Pacific whiting migrate from their summer feeding grounds off Oregon and Washington to their winter spawning grounds off southern California and Baja California. By contrast, kelp bass, which can live to 30 years, venture less than a mile from their home range.

Individual plants and animals are part of larger communities that are linked in many ways. One of the clearest of relationships concerns who eats whom, also known as the food web. Generally, the eating begins with herbivores, who consume plants that have manufactured food through photosynthesis. These herbivores may be as small as the larva of an anchovy or as large as a basking shark. The smaller herbivores pass along much of the food value of the plants when they are eaten by primary carnivores, which in turn may be consumed by higher level carnivores.

These relationships among wildlife populations differ considerably among different habitats and communities. A decrease in the abundance of some species, due to fishing, habitat alteration, or climate changes, for instance, can affect species that feed upon them. Considering these interrelationships when managing fisheries requires an ecosystem perspective.

Healthy habitat can also play an important role in the abundance of marine wildlife. Some species of fish and shellfish are so dependent upon particular types of habitat, such as kelp forests or coastal wetlands, that the destruction or natural alteration of these habitats can devastate wild populations. The damming many major coastal river in California has driven most runs of Pacific salmon to dangerously low levels. Since the 1850s, 90 percent of the state's coastal wetlands have been destroyed, causing incalculable losses in coastal wildlife. Finally, pollution of coastal waters can expose marine animals to toxic chemicals and can foster changes in plant communities that wildlife depends upon.

Recent Developments

In the late 1990s, the Legislature responded to the shifts in understanding and public values as well as declines in some fisheries and nearshore ecosystems by adopting the Marine Life Management Act (MLMA) in 1998 and the Marine Life Protection Act (MLPA) in 1999.

Before the MLMA, the responsibility for managing most of California's marine resources harvested by commercial fisheries lay with the State Legislature, while the Department of Fish and Game and the Fish and Game Commission managed the recreational fisheries and those commercial fisheries that had catch quotas that changed periodically. Management of commercial fisheries under this division of responsibility was complicated, piecemeal, and oftentimes untimely, with necessary regulatory changes only occurring after much political deliberation and approval by both the Assembly and the Senate. In addition, this division of authority often resulted in laws and regulations that were inappropriate for the sustainability of the resource.

The MLMA transferred permanent management authority to the Fish and Game Commission for the nearshore finfish fishery, the white seabass fishery, emerging fisheries, and other fisheries for which the Commission had some management authority prior to January 1, 1999. As importantly, the MLMA broadened the focus of fisheries management to include consideration of the ecosystem—that is, the species that interact with a fishery.

In passing the MLPA, the Legislature recognized the benefits of setting aside some areas under special protection and of insuring that these marine protected areas (MPAs) were developed in a systematic manner, with clear goals and objectives, and effective management plans and programs for monitoring and evaluating their effectiveness. Rather than focusing on one use or value for marine areas, the MLPA recognized a wide range of values, including the conservation of biological diversity.

California is able to take advantage of several decades of experience and study regarding MPAs elsewhere in the United States and abroad, as well as within its own waters. As is the case in other areas

of natural resource management and conservation, including fisheries management, there is much to learn about the effective design of MPAs and their benefits.

Recent work supports the legislative findings of the MLPA. In 2001, for instance, a committee of the National Academy of Sciences released its report *Marine Protected Areas: Tools for Sustaining Ocean Ecosystems*. Like other reports of the National Academy of Sciences, this report can be considered an authoritative general review of the science of marine protected areas. Among other things, this expert panel concluded:

- A growing body of literature documents the effectiveness of marine reserves for conserving habitats, fostering the recovery of overexploited species, and maintaining marine communities.

- Networks of marine reserves, where the goal is to protect all components of the ecosystem through spatially defined closures, should be included as an essential element of ecosystem-based management.

- Choosing a location for a marine reserve or protected area requires an understanding of probable socioeconomic impacts as well as the environmental criteria for siting.

- It is essential to involve all potential stakeholders at the outset to develop plans for MPAs that enlist the support of the community and serve local conservation needs.

- Marine reserves and protected areas must be monitored and evaluated to determine if goals are being met and to provide information for refining the design of current and future MPAs and reserves.

- Sufficient scientific information exists on the habitat requirements and life-history traits of many species to support implementation of marine reserves and protected areas to improve management.

In these and other ways, the MLPA reflects state-of-the-art understanding of the opportunities afforded by networks of marine reserves, marine parks, and marine conservation areas.

Master Plan Framework

The MLPA calls for the development of a master plan by the Department of Fish and Game, and its adoption by the Fish and Game Commission. The MLPA Initiative has divided the master plan into two principal parts: a section providing guidance in the application of the MLPA to the development of a statewide MPA network, and a section describing the preferred alternatives for MPA network components that will make up the overall system. The MLPA Initiative is initially focusing on developing the former section as a basis for developing the latter section over the next six years.

This draft master plan framework is meant to establish and guide a process for implementing the MLPA through the design and adoption of MPA network components in each region along the California coast.

In the coming years, application of the master plan's guidance in individual regions will no doubt lead to changes in the guidance itself. In this sense, this master plan framework should be viewed as a living document that should change adaptively to experience. When MPA network components have been adopted by the Commission for all regions by 2011, the requirements of the MLPA for the adoption of a master plan will be met.

It is important to emphasize that this master plan framework is meant to guide decision making about MPA network components in individual regions. Specific application of this guidance will depend upon the physical, biological, social, and economic conditions in a particular region. Over the coming months, more specific guidance will be provided initially in support of the development and evaluation of alternative proposals for an MPA network component on the central coast. This more specific guidance will expand upon topics identified in the master plan framework, including the design and evaluation of different types of MPAs as well as monitoring and evaluation, for instance.
The central coast effort will provide concrete experience with applying the Master Plan Framework and this more specific guidance to a specific area. This experience, in turn, may lead to recommendations to adjust the Master Plan Framework and the guidance on specific topics. In this way, the Master Plan Framework will serve as the foundation for an evolution of practice that adapts to new information.

Section 2. Design of MPAs and the MPA Network

An important aim of the MLPA is "to modify the existing collection of MPAs to ensure that they are designed and managed according to clear, conservation-based goals and guidelines that take full advantage of the multiple benefits that can be derived from the establishment of marine life reserves" [FGC 2851(h)]. At FGC subsection 2853(a), the MLPA states that "there is a need to reexamine and redesign California's MPA system to increase its coherence and its effectiveness at protecting the state's marine life, habitat, and ecosystems." These statements of intent reflect the findings of the Legislature that existing MPAs have not effectively protected California's marine heritage, including its marine biological diversity, marine ecosystems, marine habitats, and marine fisheries [FGC 2851(a-d)].

In referring to the state's existing and future collection of MPAs, the MLPA uses the terms "system" and "network." The MLPA requires that the reformed collection of MPAs have such features as clearly identified goals and objectives, and that they be "designed and managed, to the extent possible, as a network" [FGC subsection 2853(b)6]. In FGC subsection 2852(a)2(F), the MLPA requires the selection of "a preferred siting alternative for a network of MPAs." This preferred alternative will emerge from phased decisions regarding network components of MPAs within regions.

Although neither statute nor legislative history defines "network," the ordinary dictionary usage contemplates *interconnectedness* as a necessary characteristic of the term. The term "reserve network" has been defined as a group of reserves which is designed to meet objectives that single reserves cannot achieve on their own (Roberts and Hawkins, 2000). In general this definition also requires some direct or indirect connection of MPAs through the dispersal of adult and/or larval organisms. In some cases, larval dispersal rates are not known and oceanography or ocean current patterns are combined with larval biology to help determine connectivity.

Network components, however, may differ in each region. The MLPA also requires that the network as a whole meet the various goals and guidelines set forth by the law and contemplates the adaptive management of that network [Fish and Game Code Section 2857(c)(5)]. In order to meet those goals a strict interpretation of an ecological network across the entire State may not be possible. Biologically, there are separations between various oceanographic regions. Many species would not be expected to cross these separations. While the concept of a network within an oceanographic region is viable, the ultimate goal of the MLPA is to develop a statewide network of MPAs.

Because of the phased approach of the MLPA Initiative, this statewide network will be developed in phases, region by region. Within each region, components of the statewide network will be designed consistent with the MLPA and with regional goals and objectives. Each component ultimately will be presented as a series of options, developed in a regional process involving a regional stakeholder group and a sub-group of the Master Plan Science Advisory Team, with a preferred alternative identified by DFG. The preferred alternative will become, upon adoption by the Fish and Game Commission, one component of the statewide network called for by the MLPA. In developing alternative regional network components, the aim will be to ensure that the design, management, and monitoring of the individual MPAs within the alternative are closely and explicitly related to one another, to regional goals

and objectives, and to the MLPA. To the extent possible, MPAs in a statewide network may also be linked biologically.

This section of the draft master plan framework sets out a process for achieving the MLPA's goal of improving California's system of MPAs. After discussing those sections of the MLPA which relate to a statewide MPA network, this section then describes a process for developing proposals for MPA networks and individual state marine reserves, state marine parks, and state marine conservation areas.

As part of the process of designing the initial set of MPAs in the central coast study region, a regional stakeholder group, the science team's regional sub-group, the science team, and the task force will develop and adopt more specific guidelines on design of MPAs. As these guidelines are developed, they will be incorporated as appendices to the Master Plan Framework and applied in other regions. It is expected that experience in each region will lead to further refinements of the guidelines. In this and other ways, this Master Plan Framework will apply adaptive management to meeting the goals of the MLPA.

The Marine Life Protection Program

The foundation for achieving the aims of the MLPA is a Marine Life Protection Program (MLPP), which must be adopted by the California Fish and Game Commission. The MLPA sets the following goals for the MLPP [FGC subsection 2853(b)]:

> (1) To protect the natural diversity and abundance of marine life, and the structure, function, and integrity of marine ecosystems.
> (2) To help sustain, conserve, and protect marine life populations, including those of economic value, and rebuild those that are depleted.
> (3) To improve recreational, educational, and study opportunities provided by marine ecosystems that are subject to minimal human disturbance, and to manage these uses in a manner consistent with protecting biodiversity.
> (4) To protect marine natural heritage, including protection of representative and unique marine life habitats in California waters for their intrinsic value.
> (5) To ensure that California's MPAs have clearly defined objectives, effective management measures, and adequate enforcement, and are based on sound scientific guidelines.
> (6) To ensure that the state's MPAs are designed and managed, to the extent possible, as a network.

Meeting the goals of the MLPA requires that an MPA network reflect these goals in their own goals, objectives, management, monitoring, and evaluation.

[[*These goals will be discussed in greater detail upon completion of a review of possible definitions of key terms.***]]**

Process for Developing Alternative Statewide MPA Networks

This Master Plan Framework seeks to meet the requirement of the MLPA for the establishment of a statewide network of MPAs by developing components of the statewide network region by region. In general terms, this regional process begins with the development of alternative proposals for MPAs, including marine reserves, in each region, as described generally at FGC subsection 2856(a)(2)(D). From these alternatives, a preferred alternative is selected [FGC subsection 2856(a)(2)(F)].

Getting to this end point requires several intermediate steps identified in the MLPA. Below is a general outline of these steps. Greater detail is available in the "Outline of Information Required for Proposals for Alternative Networks of Marine Protected Areas" in Appendix D.

Throughout the development of alternative proposals for MPA network components, an emphasis must be placed upon using the best readily available science, as required at FGC subsection 2855(a). The MLPA does not require complete or comprehensive science, but rather the level of science that is practicable.

This process should also draw upon the knowledge, values, and expertise of local communities and other interested parties. At FGC subsection 2855(c)(1)-(2), the MLPA specifically requires that local communities and interested parties be consulted regarding:

(1) Practical information on the marine environment and the relevant history of fishing and other resources use, areas where fishing is currently prohibited, and water pollution in the state's coastal waters.
(2) Socioeconomic and environmental impacts of various alternatives.

As described in the "Strategy for Stakeholder and Interested Public Participation" adopted by the MLPA Blue Ribbon Task Force (Appendix G), there are a variety of methods and activities for meeting these requirements. More generally, as the process for developing alternatives for MPA network components gets underway in each region, a regional working group of stakeholders will be convened. This group will serve as a focus for regional discussions regarding the major aspects of designing MPA network component alternatives, including setting goals and objectives and developing options on the type, location, size, and boundaries for individual components of the network. In doing so, the regional working group will work closely with a sub-team of the science team, and both of these groups will be provided organizational, process, and scientific support by DFG and the MLPA Initiative staff.

In developing MPA proposals for the central coast study region, summaries of regional discussions will regularly be reported to the MLPA Blue Ribbon Task Force and the Fish and Game Commission. At major points in the regional process, such as the setting of goals and objectives, recommendations from the regional working group and sub-group of the science team will be presented to the full science team for its review and comment, and forwarded to the MLPA Blue Ribbon Task Force for its review and adoption. These recommendations will then be provided to DFG for review and presentation to the Fish and Game Commission. The intent is to engage all levels at critical stages throughout the MPA network development process.

Once goals and objectives for the initial regional MPA proposal have been adopted, the primary activity of the regional process will be developing alternative approaches to meeting these goals and objectives for the review of the MLPA Blue Ribbon Task Force and the Fish and Game Commission.

The first step in assembling alternative proposals for an MPA network component is to use existing information to the extent possible to identify and to map the habitats that should be represented in the system, including marine reserves [FGC subsection 2856(a)(2)(A)]. The MLPA also calls for recommendations regarding the extent and types of habitats that should be represented in the system, including marine reserves.

In making these recommendations, the basic habitat types identified in the MLPA should be used, as modified by the Master Plan Team convened in 2000. The MLPA identifies the following habitat types: rocky reefs, intertidal zones, sandy or soft ocean bottoms, underwater pinnacles, sea mounts, kelp forests, submarine canyons, and seagrass beds. The Master Plan Team reduced this basic list by eliminating sea mounts, since there are no sea mounts in state waters. The team also identified four depth zones as follows: intertidal, intertidal to 30 meters, 30 meters to 200 meters, and beyond 200 meters. Several of the seven habitat types occur in only one zone, while others may occur in three or four zones. Experience in California and elsewhere demonstrates that individual MPAs generally include several types of habitat in different depth zones, so that the overall number of MPAs required to cover the various habitat types can be relatively small. The Master Plan Team also called for considering adjacent lands and habitat types, including seabird and pinniped rookeries.

Recommending the extent of such habitat that should be included in an MPA network will require careful analysis and consideration of alternatives. These recommendations may vary with habitat and region, but should be based on the best readily available science. One aspect of determining appropriate levels of habitat coverage is the habitat requirements of species likely to benefit from MPAs in a region. At FGC subsection 2856(a)(2)(B), the MLPA requires that the Master Plan identify "select species or groups of species likely to benefit from MPAs, and the extent of their marine habitat, with special attention to marine breeding and spawning grounds, and available information on oceanographic features, such as current patterns, upwelling zones, and other factors that significantly affect the distribution of those fish or shellfish and their larvae."

DFG prepared a master list of such species, which appears in Appendix B. This list may serve as a useful starting point for identifying such species in each region during the development of alternative MPA network component proposals. This regional list then can assist in evaluating desirable levels of habitat coverage in alternative MPA network components.

Existing MPAs may then be evaluated against these recommendations on habitat coverage, against the goals and objectives of the region, the goals of the MLPA, and the design requirements in FGC Section 2857 described below. As stated in FGC subsection 2856(a)(2)(G), this evaluation can help determine "whether any specific MPAs should be consolidated, expanded, abolished, reclassified, or managed differently."

Current and anticipated human activities that may affect representative habitats should also be described generally and, if possible, spatially. These activities include aquatic activities, such as fishing and diving, as well as terrestrial, such as development and non-point and point-source pollution. Management of any activities that affect the species that may benefit from MPAs as well as representative habitats should then be assessed in relation to the goals and objectives of the MLPA.

Based on these evaluations, habitats and ecosystems that are insufficiently protected, in terms of the MLPA, by existing MPAs or other management activities such as state and federal fisheries management may be identified, and alternative proposals for enhancing existing MPAs and siting new MPAs may be developed. The "Outline of Information Required for Proposals for Alternative Networks of Marine Protected Areas" in Appendix D provides guidance on the types of information that constitute a viable alternative as well as specific questions with which alternatives may be evaluated.

The ultimate decision regarding the selection of a preferred statewide MPA network, and each regional network component, rests with the California Fish and Game Commission. The aim of regional efforts should be upon the development of alternatives and, as importantly, their evaluation against regional goals and objectives and the requirements of the MLPA. Evaluation of MPA network component alternatives that is rigorously linked to these considerations will provide the kind of information that will assist the commission in judging among different approaches to meeting the goals of the MLPA.

The Geographical Context of MPA Networks

The vehicle for guiding and implementing the Marine Life Protection Program (MLPP) is a master plan adopted by the Fish and Game Commission [FGC subsection 2855(a)]. The MLPA stipulates that the master plan include several elements. The initial focus of discussion here is the requirement for recommending to the Fish and Game Commission alternative statewide networks of MPAs, including marine life reserves in each biogeographical region that meet the MLPA's goals listed above as well as guidelines in FGC Section 2857, which will be discussed later in this section [FGC subsection 2856(a)2(D)]. The master plan must also include a preferred alternative for a statewide MPA network, chosen from the above alternatives, that also is consistent with the goals described above and the design guidelines in FGC Section 2857 [FGC subsection 2856(a)2(F)]. This emphasis upon a network design reflects one of the goals of the MLPA—that is, to design and manage the state's MPAs as a network, to the extent possible [FGC subsection 2853(b(6].

In calling for a statewide network of MPAs, to the extent possible, the MLPA also recognizes that the state spans several biogeographical regions, and identified these, initially, as follows [FGC subsection 2852(b)]:

- The area extending south from Point Conception,
- The area between Point Conception and Point Arena, and
- The area extending north from Point Arena.

In the same provision, the MLPA provides authority for the master plan team required by FGC subsection 2855(b)(1) to establish an alternate set of boundaries. The Master Plan Team convened by

the Department of Fish and Game in 2000 determined that the three regions identified in the MLPA were not zoogeographic regions; scientists recognize only two zoogeographic regions between Baja California and British Columbia. Instead of the term "biogeographical region," the team adopted the term "marine region" and identified four marine regions:

- North marine region: California-Oregon border to Point Arena (about 183 linear nautical miles of coastline);
- North-central marine region: Point Arena to Point Año Nuevo (about 156 nautical miles of coastline);
- South-central marine region: Point Año Nuevo to Point Conception (about 203 nautical miles of coastline); and
- South marine region: Point Conception to the California-Mexico border, including the islands of the southern California Bight (about 243 nautical miles of coastline).

These four marine regions will serve as the initial basis for designing a statewide MPA network, unless the science team determines otherwise, as provided by FGC subsection 2855(b)(1). It is these marine regions, not whatever study regions may be adopted for planning purposes, that will be the basis for determining whether adequate coverage of representative habitats and communities occurs in marine reserves [FGC subsection 2857(c)3].

As noted above, the MLPA requires that the master plan include proposals for alternative statewide MPA networks and recognize one of these as the preferred alternative statewide network. This Master Plan Framework phases in the development of alternatives and a preferred alternative, region by region through 2011, as authorized by FGC subsection 2857(e). The timing for the development and adoption of MPA network components in the regions will be based on experience with the initial effort on the central coast, on findings of the long-term funding strategy, and continuing discussions.

General Design Features of MPA Networks

In assembling components of a statewide MPA network region by region, this Master Plan Framework seeks to promote the eventual creation of a statewide system by identifying specific design guidelines consistent with the MLPA. Chief among these guidelines are the following.

At FGC subsection 2853(c), the MLPA allows that the Marine Life Protection Program "may include areas with various levels of protection." These various levels of protection are represented by state marine reserves, state marine parks, and state marine conservation areas as defined in the Marine Managed Areas Improvement Act (see Endnote 1.1 for definitions)

Whether MPAs within a regional component of the statewide network are reserves, parks, or conservation areas, or some combination of the above, the MLPA specifies that all MPAs have certain features. First, the MLPA requires that the MLPP include MPAs that have "specific identified objectives" (FGC subsections 2853[c]2 and 2857[c]1). The MLPA provides some options for what these objectives are. At FGC subsection 2857(c)1, the MLPA says that "[i]ndividual MPAs may serve varied primary purposes while collectively achieving the overall goals and guidelines of this chapter." At FGC

subsection 2857(b), the MLPA also states that MPAs may aim to achieve either or both of the following objectives:

(1) Protection of habitat by prohibiting potentially damaging fishing practices or other activities that upset the natural ecological functions of the area.
(2) Enhancement of a particular species or group of species, by prohibiting or restricting fishing for that species or group within the MPA boundary.

Setting goals and objectives for regional components of a statewide network and for individual MPAs within these components will be a critical first step in developing meaningful alternatives for a statewide MPA network and for individual MPAs within those alternatives, in selecting a recommended network of MPAs, and in the design of monitoring and evaluation of regional network components. Assembling and evaluating available information on the biological, oceanographic, socio-economic, and governance features of a region, including existing MPAs, should precede setting regional goals and objectives. Similarly, setting regional goals and objectives should precede setting goals and objectives for individual MPAs and network components as well as designing boundaries and management measures for individual MPAs.

Baseline data needs for MPAs should be drafted for inclusion in the regional MPA management plan described elsewhere in the Master Plan Framework (see Endnote 3.1). Examples of such baseline information needs are:

- Status of recreational and commercial marine resources in the region
- Status of species in need of restoration
- Analysis of activities affecting living marine resources in the region

Additional types of baseline information needs will be identified during the central coast study region process.

There are a variety of techniques for setting goals and objectives. No one technique is likely to suit the diverse situations in all regions.[1] Deciding upon a process for setting goals and objectives should be an early focus for regional discussions. In fashioning goals, the following characteristics should be kept in mind (Pomeroy et al. 2004). A goal is a broad statement of intent that is:

- Brief and clearly defines the desired long-term vision and/or condition that will result from effective management of the MPA;
- Typically phrased as a broad mission statement; and
- Simple to understand and communicate.

[1] Reviews of MPAs around the world have identified common types of goals and objectives that may be helpful in designing individual regional networks and individual MPAs. A summary of these appears in Endnote 1.2

An objective is a more specific measurable statement of what must be accomplished to attain a goal. Usually, attaining a goal requires accomplishing two or more objectives. Useful objectives have the following features:

- Specific and easily understood;
- Written in terms of what will be accomplished, not how to go about it;
- Realistically achievable;
- Defined within a limited time period; and
- Can be measured and validated.

In developing regional goals and objectives, attention should be paid as well to other complementary programs. For instance, like the MLPA, the Marine Life Management Act (MLMA) takes an ecosystem-based approach to management. The Nearshore Fishery Management Plan (NFMP) required by the MLMA identified MPAs as an important tool in achieving its goals and objectives. While the NFMP deferred to the MLPA process in designing and establishing networks of MPAs, it also identified key features of MPA networks that would contribute to the goals and objectives of the NMFP and the MLMA. Other fishery management plans should be reviewed for similar linkages.

Once developed, regional goals and objectives can be matched with the goals of the different types of MPAs, as defined by the Marine Managed Areas Improvement Act (MMAIA) at PRC Section 36700 and in the MLPA. The MMAIA defines the goals for the three types of MPAs as shown in Table 1.

Table 1

Purpose	State Marine Reserve	State Marine Park	State Marine Conservation Area
Protect or restore rare, threatened, or endangered native plants, animals, or habitats in marine areas.	**X**		**X**
Protect or restore outstanding, representative, or imperiled marine species, communities, habitats, and ecosystems.	**X**	**X**	**X**
Protect or restore diverse marine gene pools.	**X**		**X**
Contribute to the understanding and management of marine resources and ecosystems by providing the opportunity for scientific research in outstanding, representative, or imperiled marine habitats or ecosystems.	**X**	**X**	**X**
Provide opportunities for spiritual, scientific, educational, and recreational		**X**	

opportunities			
Preserve cultural objects of historical, archaeological, and scientific interest in marine areas.		**X**	
Preserve outstanding or unique geological features.		**X**	**X**
Provide for sustainable living marine resource harvest.			**X**

Although the MLPA does not identify specific goals and objectives for marine parks and marine conservation areas, it does identify possible functions, which may be considered as goals, for marine reserves. At FGC subsection 2851(f), the MLPA says that marine reserves:

- protect habitat and ecosystems,
- conserve biological diversity,
- provide a sanctuary for fish and other sea life,
- enhance recreational and educational opportunities,
- provide a reference point against which scientists can measure changes elsewhere in the marine environment, and
- may help rebuild depleted fisheries.

As mentioned above, the MLPA recognizes that individual MPAs within a statewide network may have several goals and objectives, such as protection of biological diversity and enhancement of recreational opportunities. In these instances, special care should be taken in designing management measures, such as restrictions as well as data collection and monitoring, which will maximize the different objectives and quantify whether different objectives are being met.

The benefits from MPA designation of an area may also be increased, and potential negative socio-economic impacts may be decreased, through zoning. For instance, a core zone within a candidate area may be designated a marine reserve, while the adjacent area is designated a marine park or a marine conservation area, thereby serving as a buffer and as a reference area for the core zone and other purposes (Salm et al. 2000; Kelleher and Kenchington 1992).

The Design of MPAs

As described above, the process of designing MPAs within an MPA network regional component begins with an evaluation of habitats within a region, identification of threats, setting of regional goals and objectives, and identification of gaps in habitat coverage. In the next stage of the MLPA Initiative, the focus of attention narrows to specific study areas that include representative habitats and other resources that would benefit from inclusion within one or a combination of MPA types and that would contribute to the requirements of the MLPA for protection of representative habitats in marine reserves.

Once a study region has been identified, it then is necessary to determine what MPA type or combination of MPA types might be appropriate. The MLPA recognizes the role of different types of MPAs in achieving the objectives of the Marine Life Protection Program [FGC subsection 2853(c)]. The MMAIA defines three types of MPAs: state marine reserve, state marine park, and state marine conservation area. Depending upon these goals and objectives, the appropriate type or combination of MPA types may be selected for development based on the purposes summarized above.

Besides somewhat different purposes, each type of MPA represents a different level of restriction on activities within MPA boundaries. These restrictions and purposes suggest how each designation can be used effectively in a system of MPAs.

- A state marine reserve prohibits taking living, geological, or cultural resources and must maintain the area "to the extent practicable in an undisturbed and unpolluted state" [PRC subsection 36710(a)]. The responsible agency may permit research, restoration, or monitoring. Such activities as boating, diving, research, and education may be allowed, to the extent feasible, so long as the area is maintained "to the extent practicable in an undisturbed and unpolluted state." Such activities may be restricted to protect marine resources.

- A state marine park prohibits commercial use of living or nonliving marine resources. Other uses that would compromise the protection of living resources, habitat, geological, cultural, or recreational features may be restricted. All other uses are allowed, consistent with protecting resources.

- In a state marine conservation area, activities that would compromise the protection of species of interest, the natural community, habitat, or geological features may be restricted. Research, education, and recreational activities, as well as commercial and recreation catches may be permitted.

State Marine Reserves

While the MLPA alludes to other types of MPAs [FGC subsection 2853(c)], it highlights the use of state marine reserves, hereafter called "marine reserves." Within this general scheme, the MLPA emphasizes the role of marine reserves in several ways. First, the MLPA requires that the Marine Life Protection Program include "an improved marine life reserve component" consistent with the guidelines that will be discussed later [FGC subsection 2853(c)(1)]. Second, the Legislature cited several reasons for focusing upon marine reserves, as stated above [FGC subsection 2851(e)-(g)]. The MLPA then states the following:

(g) Despite the demonstrated value of marine life reserves, only 14 of the 220,000 square miles of combined state and federal ocean water off California, or six-thousandths of 1 percent, are set aside as genuine no take areas.
(h) For all of the above reasons, it is necessary to modify the existing collection of MPAs to ensure that they are designed and managed according to clear, conservation-based goals and guidelines

> that take full advantage of the multiple benefits that can be derived from the establishment of marine life reserves.[2]

At FGC subsection 2853(c)(1), the MLPA also calls for an improved "marine life reserve component."

Finally, in its definition of a "marine life reserve" at FGC subsection 2852(d), the MLPA sets a high standard of protection when it requires that "the area shall be maintained to the extent practicable in an undisturbed and unpolluted state." Similarly, at FGC subsection 2857(c)(4), the MLPA states that reserves "shall be designed, to the extent practicable, to ensure that activities that upset the natural ecological functions of the area are avoided."

Given this emphasis within the MLPA, marine reserves must be considered as foundational elements of regional MPA network components, although they are not the only elements. Indeed, the design of MPA network components may generate the greatest benefits by combining core zone marine reserves with the less restrictive designations of marine park and marine conservation area, as mentioned above.

The MLPA sets other requirements for the use of marine reserves. At FGC subsection 2857(c)(3), the MLPA requires "[s]imilar types of marine habitats and communities shall be replicated, to the extent possible, in more than one marine life reserve in each biogeographical region." Consistent with this approach, this Master Plan Framework foresees that in each region, all of the above habitat types and depth zones identified by the Master Plan Team in 2000 are included in at least two marine reserves. As mentioned above, several of the seven habitat types occur in only one depth zone, while others may occur in three or four depth zones. Experience in California and elsewhere demonstrates that individual MPAs generally include several types of habitat in different depth zones, so that the overall number of marine reserves required to cover the various habitat types can be relatively small.

Marine reserves may be designed to accomplish several goals and objectives or combinations of these. Taken together, the MLPA and MMAIA define three general categories of goals for marine reserves:

- Protecting and restoring marine habitats, ecosystems, and biological diversity;
- Enhancing recreational and educational opportunities; and
- Increasing the understanding of marine systems.

Proposals for marine reserves should clearly articulate how their goals and objectives are consistent with these general guidelines as well as with regional goals and objectives.

Besides reflecting the MLPA and regional goals, the goals and objectives for individual marine reserves and other types of MPAs should reflect the views of stakeholders and the judgment of the science team, using the best readily available science, through an iterative process.

[2] The MLPA uses the terms "sealife reserve" once and "marine life reserve" elsewhere. The MLPA defined "marine life reserve" in the same way that the Marine Life Management Areas Improvement Act does. Therefore, the two phrases can be considered synonymous.

Once set, goals and objectives will influence crucial design decisions regarding size, location, and boundaries. For instance, a marine reserve whose primary goal is protection of biological diversity may well have a different configuration than a marine reserve whose goal is enhancement of depleted fisheries (Nowlis and Friedlander 2004). Benefits for conservation of biological diversity appear to increase directly rather than proportionally with the size of reserves (Halpern 2003).

For reserves with fisheries benefits as a primary objective, size and location also will be influenced by the choice of focal species and their life history characteristics. There is a growing literature regarding the relationship between the life history of focal species and the size and location of marine reserves, and by extension, other types of MPAs (NRC 2001; Botsford et al. 2003; NFCC 2004; Nowlis and Friedlander 2004). In general, such marine reserves need to be scaled to the movements of their focal species during various life history stages (Gell and Roberts 2003), which are often strongly associated with the distribution of habitats.

The effectiveness of a marine reserve, as well as other types of MPAs and entire MPA networks, will depend also upon effective plans for monitoring and evaluation, enforcement, and management as the MLPA requires at CFG subsections 2853(b)(5), 2853(c)(2) and (3), and 2856(a)(2)(H) and (I). These aspects of marine reserve design are taken up in sections 3, 4 and 5 of this Master Plan Framework.

State Marine Parks and State Marine Conservation Areas

As noted in Table 1 and elsewhere above, state marine parks and state marine conservation areas, hereafter called "marine parks" and "marine conservation areas," differ from marine reserves to different degrees in their purposes as well as the type of restrictions. Unlike marine reserves, these two types of MPAs allow some level of fishing. The types of commercial and/or recreational restrictions on fishing may vary with the focal species, habitats, and goals and objectives of an individual MPA within a network. Where a goal is biodiversity conservation, restrictions on fishing may be different from those in an MPA where the primary goal is enhancing recreational opportunities.

Marine parks and marine conservation areas have an especially valuable role to play in designing MPAs that accommodate a spectrum of uses (NRC 2001; Salm et al. 2000). Zoning plans that use all three types of MPAs make it possible to separate incompatible uses and to define management areas that protect ecosystem attributes of concern while allowing compatible uses (NRC 2001). For instance, zoning might buffer a marine reserve with a marine park in which some types of recreational fishing are regulated but allowed or a marine conservation area in which both commercial and recreational fishing are allowed but certain types of gear are not. In some cases, such as specialized fisheries where adults remain in small areas, it may be possible to enlist users in the management, monitoring and enforcement of the protections enacted.

Zoning can be particularly useful as an element in adaptive management (NRC 2001). Different restrictions in different areas can help in determining the impact of different activities and in determining the relative effects of fishing, environmental degradation, and other factors.

In developing alternatives for the initial central coast study region MPA network component, the regional working group, the full science team and its regional sub-group, and the MLPA Blue Ribbon

Task Force will develop guidance regarding the design of individual MPAs, MPA network components, and zoning that can later be incorporated into this Master Plan Framework for application in the development of MPA network components in other regions.

Enforcement and Public Awareness Considerations in Setting Boundaries

Regardless of the amount of enforcement funding, personnel or equipment available the enforceability and public acceptance and understanding of marine protected areas will be enhanced if a number of criteria are considered when they are being designed and sited. While the complexities of the California coastline and locations and distributions of habitats and resources which are being protected make using the same criteria at each location difficult, an effort should be made to include as many of these considerations as possible.

Marine protected area boundaries should be clear, well-marked, recognizable, measurable and defensible. Selecting known, easily recognizable landmarks or shoreline features, where possible, as starting points for marine protected area boundaries will provide a common, easily referenced understanding of those boundaries. Marine protected area boundaries should be straight lines that follow North-South and East-West coordinates while avoiding fractional latitude or longitude lines wherever possible. Likewise, any offshore corners or boundary lines should be located at easily determined coordinates. This is especially true if installation and maintenance of boundary marker buoys is not cost effective or feasible. Using depth contours or distances from shore as boundary designations should be avoided, if possible, due to ambiguities in determining exact depths and distances.

Siting marine protected areas in locations that are accessible and/or observable, either from the shore or the water, can increase the likelihood that potential illegal activities will be observed and reported, discourage such activities because they might be observed and increase public awareness of the MPA. Siting marine protected areas within, or near, locations under special management (national marine sanctuaries and parks, state and local parks and beaches, research facilities, museums and aquaria, etc) may provide an added layer of enforcement, observation and public awareness. This is especially true if there are shore-side facilities and personnel based at the site.

Designing marine protected areas to include "buffer" zones surrounding core habitat or resource areas can lessen the chance that intentional or unintentional violations of the protective regulations in the core area might occur. A buffer could be an area of lesser protection surrounding the core area. Simply designing marine protected areas to cover fewer, but relatively large areas rather than many smaller ones may not only improve the public's recognition of the site, but also allow enforcement personnel to more easily determine when a potential violation may be occurring.

Endnote 2.1: Definitions of Marine Protected Areas

The Marine Management Areas Improvement Act (Public Resources Code Section 36700), defines six classifications of marine managed areas. Three of these are marine protected areas, which are defined as follows:

> (a) A "state marine reserve" is a nonterrestrial marine or estuarine area that is designated so the managing agency may achieve one or more of the following:
> (1) Protect or restore rare, threatened, or endangered native plants, animals, or habitats in marine areas.
> (2) Protect or restore outstanding, representative, or imperiled marine species, communities, habitats, and ecosystems.
> (3) Protect or restore diverse marine gene pools.
> (4) Contribute to the understanding and management of marine resources and ecosystems by providing the opportunity for scientific research in outstanding, representative, or imperiled marine habitats or ecosystems.
>
> (b) A "state marine park" is a nonterrestrial marine or estuarine area that is designated so the managing agency may provide opportunities for spiritual, scientific, educational, and recreational opportunities, as well as one or more of the following:
> (1) Protect or restore outstanding, representative, or imperiled marine species, communities, habitats, and ecosystems.
> (2) Contribute to the understanding and management of marine resources and ecosystems by providing the opportunity for scientific research in outstanding representative or imperiled marine habitats or ecosystems.
> (3) Preserve cultural objects of historical, archaeological, and scientific interest in marine areas.
> (4) Preserve outstanding or unique geological features.
>
> (c) A "state marine conservation area" is a nonterrestrial marine or estuarine area that is designated so the managing agency may achieve one or more of the following:
> (1) Protect or restore rare, threatened, or endangered native plants, animals, or habitats in marine areas.
> (2) Protect or restore outstanding, representative, or imperiled marine species, communities, habitats, and ecosystems.
> (3) Protect or restore diverse marine gene pools.
> (4) Contribute to the understanding and management of marine resources and ecosystems by providing the opportunity for scientific research in outstanding, representative, or imperiled marine habitats or ecosystems.
> (5) Preserve outstanding or unique geological features.
> (6) Provide for sustainable living marine resource harvest.

Note that the MLPA defined “marine life reserve” as follows [FGC subsection 2852(d)]:

"Marine life reserve," for the purposes of this chapter, means a marine protected area in which all extractive activities, including the taking of marine species, and, at the discretion of the commission and within the authority of the commission, other activities that upset the natural ecological functions of the area, are prohibited. While, to the extent feasible, the area shall be open to the public for managed enjoyment and study, the area shall be maintained to the extent practicable in an undisturbed and unpolluted state.

Endnote 2.2: Common Goals and Objectives for Marine Protected Areas

Conservation of biodiversity and habitat

Protect depleted, threatened, rare, or endangered species or populations
Preserve or restore the viability of representative habitats and ecosystems
To gain better information about marine ecology and human impacts on it
To address issues surrounding species of special concern
Biological diversity protected
Habitat protected
Individual species protected
Degraded areas restored
Marine resources sustained or protected
Maintain genetic/species diversity
Conserve habitat and biota
Protect rare/important species
Recolonize exploited areas
Protect coastlines
Marine resources sustained or protected

Fishery management

Control exploitation rates
Protect critical stages of the species' life history
Reduce secondary fishing impacts
Ensure against possible failures of conventional regulatory systems
Conserve life-history traits and genetic diversity
To act as a tool to regulate levels of natural resource harvest
Marine resources sustained or protected
Individual species protected
Protect rare/important species

Scientific knowledge

Provide a source of baseline data
To provide a testing ground for management
Environmental awareness and knowledge enhanced
Promote research
Allow for baseline monitoring

Educational opportunities

Environmental awareness and knowledge enhanced
Allow creation of education and training areas

To gain better information about marine ecology and human impacts on it

Enhancement of recreational activities and tourism

Promote tourism and recreation
Preserve aesthetic value
Protect intrinsic and/or absolute value of an area

Sustainable environmental benefits

Non-monetary benefits to society enhanced or maintained
Promote sustainable development
Protect intrinsic and/or absolute value of an area
Allow for alternative economic development

Protection of cultural heritage

Compatibility between management and local culture maximized
Protect historic cultural sites

General governance - new category

Effective management structures and strategies maintained
Effective legal structures and strategies for management maintained
Effective stakeholder participation and representation ensured
Management plan compliance by resource users enhanced
Resource use conflicts managed and reduced
Exert political influence or assert jurisdiction
To buffer against unforeseeable future management mistakes (precautionary principle)
To provide a sense of place that people can relate to and in which they can take ownership
To empower local users to have a collective voice in decision-making about resource use and allocation

Stakeholder (local and/or general) capacity building - new category

To provide a sense of place that people can relate to and in which they can take ownership
To empower local users to have a collective voice in decision-making about resource use and allocation
Food security enhanced or maintained
Livelihoods enhanced or maintained
Benefits from the MPA equitably distributed
Environmental awareness and knowledge enhanced
Allow for alternative economic development

Sources: Agardy 1995, Jones 1994, NRC 2001, Pomeroy et al. 2004, Salm et al. 2000.

Section 3. Management

Without effective management, MPAs and MPA networks become "paper parks," and their goals, objectives, and benefits are not achieved (Kelleher et al. 1995). In its findings and declarations, the MLPA identified the lack of effective management and enforcement as a major problem for many existing MPAs in California: "Many of these MPAs lack clearly defined purposes, effective management measures and enforcement. As a result, the array of MPAs creates the illusion of protection while falling far short of its potential to protect and conserve living marine life and habitat "(FGC Section 2851[a]).

Consistent with this concern, one of the goals of the Marine Life Protection Program mandated by the MLPA is "[t]o ensure that California's MPAs have clearly defined objectives, effective management measures, and adequate enforcement, and are based on sound scientific guidelines" (FGC Section 2853[b]5). Among the required elements of the program are "[s]pecific identified objectives, and management and enforcement measures, for all MPAs in the system" (FGC Section 2853[c]2). Similarly, the MLPA also requires that the Master Plan include "[r]ecommendations for management and enforcement measures for the preferred alternative that apply systemwide or to specific types of sites and that would achieve the goals of this chapter" (FGC Section 2856[a]2[I]).

Finally, the MLPA requires that the system of MPAs established under the Marine Life Protection Program be managed adaptively through effective monitoring, research, and evaluation in selected areas and through adequate funding (FGC Section 2856[a]2[H and K]). These latter requirements are discussed in Section 5.

The initial focus for meeting the management requirements of the MLPA should be the preparation of a management plan for each MPA network component. Besides guiding day-to-day management, research, education, enforcement, monitoring, and budgeting, a management plan also distills the reasoning for key elements of the network that should be monitored, evaluated, and revised in response to new information and experience.

Endnote 3.1 presents a suggested outline for a regional MPA network component management plan. Much of the material required to complete this management plan will be developed in the course of designing, evaluating, and establishing a specific MPA network component, since the outline is based largely on the Outline of Information Required for Proposals for Alternative Networks of Marine Protected Areas in Appendix D.

Some elements of management, such as monitoring and evaluation, enforcement, and financing, are described elsewhere in this Master Plan.

Besides these elements, management plans should set out explicit goals and objectives, the strategy being used to address threats and to achieve other objectives, and the activities that will be undertaken over a specified time and period (Pomeroy et al. 2004). Like objectives for individual MPAs and for

MPA networks, activities to address threats and meet objectives should include clear and measurable targets.

Budgets should be linked to these targets, activities, objectives, and goals, and be based upon a range of costs and revenues reflecting expressed assumptions about revenues, especially. Budgets should identify necessary and desirable staff positions and funding for administration, education and interpretation, coordination of research and monitoring, and enforcement, as well as capital and operational costs for such assets as facilities, boats, and vehicles.

Management plans should not dwell upon detail, but should provide a foundation for developing more specific action plans, as necessary, and for adapting management measures to new information. Management plans should include a schedule for review and possible revision at least every five years, and a mechanism for revisions in the interim in response to significant events, such as unexpected monitoring results, budget shifts, or changes in the status of the populations of focal species or of habitats or in the character or effectiveness of management outside individual MPAs.

A management plan should describe the allocation of responsibility to various government agencies and non-government organizations for carrying out specific management activities. While the California Department of Fish and Game, and in some circumstances the California Department of Parks and Recreation, exercise primary authority for the management of California's MPAs, these agencies can draw upon each other and upon the capacity of other agencies and organizations in carrying out critical management activities.

In meeting needs for research, monitoring, enforcement, and public education activities, MPA network components should look to collaboration with federal agencies, such as the collaboration with the Channel Island's National Marine Sanctuary and the National Park Service at the MPAs established in 2002 around the Channel Islands. In some cases, such collaboration will benefit from a formal memorandum of understanding, while in other cases, collaboration can be most effectively pursued at more informal levels.

Collaboration with non-governmental organizations, including non-profit conservation and education organizations and fishermen's or divers' groups, can enhance implementation of important management activities, such as education, research, and monitoring. At the Monterey Bay National Marine Sanctuary, for instance, the Citizen Watershed Monitoring Network, a volunteer-based group, conducts monitoring according to USEPA standards. While this data is voluntarily collected and therefore may not be used for enforcement purposes, it does provide several benefits to the sanctuary that would otherwise not have the staff or funding to support such data collection. Commonly, lack of organizational capacity inhibits such cooperative ventures with stakeholder and community groups (Weber and Iudicello Martley 2004).

Engagement with local communities can be particularly important in building support for and compliance with regulations (NRC 2001). The MLPA recognizes the importance of doing so at FGC Section 2855(c), which requires that in preparing the master plan, DFG solicit local communities for information on several issues, including the design of monitoring and evaluation activities, and methods

to encourage public participation in the stewardship of the state's MPAs. To this end, DFG has commonly convened stakeholder committees to advise in the development of management plans for fisheries and other management activities such as the Channel Islands Marine Protected Areas or the regional working groups in the previous phase of MLPA implementation.

As noted earlier in this document, designing and evaluating alternative MPA network components in individual regions will benefit from the advice and involvement of working groups of stakeholders from the region in which the network component is being developed. Care must be taken to ensure that these groups represent the range of interests in the region and that the charter of the group and its role in the overall process of network design and evaluation is clear from the outset. It is important, for example, that the charter of any regional stakeholder group focus on implementation of state law and plans. To that end, the state goals to be achieved regionally should be clearly stated in the charter.

Stakeholder advisory committees should continue to play a role in the management of MPAs in a region. The management plan for a regional MPA network component should provide for continuing engagement of stakeholders through an advisory committee (Salm et al. 2000). Such a committee can fulfill a number of important roles, such as (NMSP 2004):

- Serve as a link between an MPA network component and its community, disseminating information about the MPA network component to the various constituencies of members and bringing the concerns of constituents and the public to sanctuary staff;
- Assist in creating a dialogue to examine various sides of an issue and a place for mediation;
- Identify potential partners and constituent groups with which the MPA network component should be working and forge relationships;
- Review and provide input on plans, proposals, and products, including prioritizing issues;
- Provide technical and background information on issues facing the MPA network component; and
- Validate the accuracy and quality of information used for decision making.

Key issues in convening an effective advisory committee include size and structure, such as whether to convene an overall committee within which sub-groups of the committee or working groups of non-committee members operate. As is the case with stakeholder committees advising on the design and evaluation of proposed MPA network components, the charter of the stakeholder committees convened after establishment of network components must be clear. The role of such committees may range from simply advising the Department of Fish and Game to conducting specific management tasks under the general guidance of DFG (Pomeroy and Goetze 2003).

Endnote 3.1: Suggested Outline for Management Plans of MPA Network Components

A principal vehicle for ensuring that regional MPA network components meet the goals and objectives of the MLPA is the management plan developed during the design of each regional network component. Besides guiding day-to-day management, research, education, enforcement, monitoring, and budgeting, a management plan also distills the reasoning for key elements of, or of specific MPAs within the network component that should be monitored, evaluated, and revised in response to new information and experience.

There follows a suggested outline for elements of regional MPA network component management plans. Much of the material required to complete a management plan for a regional MPA network component will already have been developed in the course of designing, evaluating, and establishing the regional MPA network component, as depicted in the Outline of Information Required for Proposals for Alternative Networks of Marine Protected Areas in Appendix D. This list of elements is suggestive only and the elements included in any specific regional plan should be appropriate to that region.

Suggested Outline of Management Plans for Regional MPA Network Components

I. Summary
   a. Name of the network component
   b. General description of the network component
   c. Objectives of network component
   d. Principal features of management

II. The Setting
   a. Description of region
      i. Legal description of the boundaries of study area
         1. Rationale for boundaries
      ii. Species or groups of species likely to benefit from MPAs (FGC §2856[a]2[B]).
         1. Distribution of these species in the region and beyond
         2. Status of these species in the region and beyond
      iii. Representative or unique marine ecosystems in the region (FGC §2853[b]1)
         1. Distribution of these ecosystems
         2. Status of these ecosystems
      iv. Distribution of representative and unique habitats in the region generally, and specifically for species likely to benefit.
      v. Distribution of oceanic features that may influence target species, including currents and upwelling zones (FGC §2856[a]2[B])
      vi. Current and anticipated distribution of human uses
         1. Aquatic, including commercial and recreational fishing, scuba diving, etc.
         2. Coastal terrestrial, including recreation, discharges, etc.
      vii. Current management of human activities affecting target species, ecosystems, and habitats.

viii. Evaluation of current management of human activities affecting target species, ecosystems, and habitats in relations to the goals and objectives of the MLPA.

III. The Regional Network component
- a. Process used to develop the proposal
- b. Gap analysis
  - i. Description of pre-existing MPAs and other relevant marine managed areas such as State Water Quality Protection Areas
  - ii. Adequacy of existing management plans and funding
  - iii. Target habitats and ecosystems entirely unrepresented
  - iv. Target habitats and ecosystems insufficiently protected by pre-existing MPAs
  - v. Target habitats and ecosystems insufficiently protected by other management activities to meet the standards of the MLPA,
  - vi. Target habitats and ecosystems insufficiently protected by pre-existing MPAs and other management activities, without replicates in the region or with replicates too widely spaced.
- c. Regional goals and objectives for a network component of MPAs
  - i. Relation of goals and objectives to the MLPA generally and to resource problems and opportunities in the region specifically
- d. General description of the network component and its management
  - i. Spacing of MPAs and overall regional level of protection
  - ii. Management measures
  - iii. Proposed monitoring for evaluating the effectiveness of the site in achieving its goals, including identification of those MPAs that will receive active monitoring
  - iv. Proposed research programs,
  - v. Proposed education programs,
  - vi. Enforcement needs and means of meeting those needs,
  - vii. Funding requirements and sources,
  - viii. Proposed mechanisms for coordinating existing regulatory and management authority,
  - ix. Opportunities for cooperative state, federal, and local management,

IV. Design of the network component:
- a. How does the network component emphasize
  - i. areas where habitat quality does (or potentially can) support diverse and high-density populations,
  - ii. benthic habitats and non-pelagic species,
  - iii. hard bottom as opposed to soft bottom
  - iv. habitats associated with those species that are officially designated as overfished, with threatened or endangered species, and productive habitats such as kelp forests and seagrass beds
- b. How does the network component include:
  - i. unique habitats,
  - ii. Help to include a variety of habitats,

iii. a variety of ocean conditions such as upwelling centers, upwelling shadows, bays, estuaries, and exposed and semi-protected coastlines?

c. How does the network component incorporate or expand upon existing MPAs that are considered to be effective?
d. How does the network component include a variety of sizes and types of MPAs that are dispersed in a network component that does the following:
    i. Provide enough space within individual MPAs for the movement of juveniles and adults of many species,
    ii. Achieve beneficial ratios of edge to area,
    iii. Facilitate analysis of the effects of different-sized MPAs,
    iv. Facilitate analysis of the effects of different types of MPAs,
    v. Provide a network of sources for larval dispersal that are interconnected,
    vi. Enable the use of MPAs as reference sites to evaluate the effects of climate change and other factors on marine ecosystems, without the effects of fishing,
    vii. Enable the use of MPAs as reference sites for fisheries management,
    viii. Minimize the likelihood that catastrophic events will impact all replicate MPAs within a biogeographic region.
    ix. If an MPA is less restrictive than a reserve, how do different uses and restrictions affect achieving the objectives immediately above?
e. How does the network component use simple and easily recognizable boundaries to facilitate identification and enforcement of MPA regulations?
f. Where feasible, how does the network component locate MPAs in areas where there is onsite presence to facilitate enforcement?
g. How does the network component consider non-extractive uses, cultural resources, and existing fisheries and fishing regulations?
h. How does the network component consider proximity to ports, safe anchorage sites, and points of access, to minimize negative impacts on people and increase benefits?
i. How does the network component facilitate monitoring of MPA effectiveness by including well-studied sites, both in MPAs and unprotected areas?

V. What are the socio-economic impacts of the proposed network component?
    a. Current uses in region and likely impact of network component on these uses
    b. Future uses in region and likely impact of the network component on these uses
    c. Costs and benefits:
        i. What uses are likely to benefit from the site, and how?
        ii. What uses are likely to suffer from the site, and how?
    d. How does the network component consider positive and negative socioeconomic consequences?

VI. What is the improved marine life reserve component of the preferred network component? (FGC §2857[c])
    a. Which species will benefit from the proposed network component and how?
    b. How does this network component meet the goals and objectives of the MLPA?

VII. Description of individual MPAs within the Preferred Network component
   a. What are the boundaries of this MPA?
   b. What is the total area of the MPA?
   c. What is the total shoreline length of the MPA?
   d. Does this MPA expand upon an existing MPA?
   e. What is the overall goal of this MPA?
   f. What are the objectives that serve this goal?
   g. What species, populations, habitats, or ecosystem functions are of most concern in this area?
   h. What are the chief threats to these features?
      i. Which of these threats are amenable to management?
      ii. What strategies are being pursued to address these threats?
      iii. What additional restrictions or designations (e.g. water quality protection areas) would help address these threats?

VIII. An assessment of the financial, human and physical resources required to establish and manage the MPA including:
   a. Staffing
   b. equipment and facilities
   c. training
   d. budget
   e. interpretation and education
   f. monitoring and research
   g. restoration
   h. surveillance
   i. enforcement
   j. contingency/emergency planning
   k. evaluation and review of effectiveness.

Appendices

Section 4. Enforcement

The MLPA identified the lack of enforcement as one of the chief deficiencies in California's existing MPAs (FGC Section 2851[a]). To remedy this deficiency, the MLPA requires that the Marine Life Protection Program provide for adequate enforcement (FGC Section 2853[b]5) and include enforcement measures for all MPAs in the system (FGC Section 2853[c]2).

This section of the Master Plan Framework addresses these requirements by responding to two requirements for the master plan identified at FGC Section 2856a(2):

> (I) Recommendations for management and enforcement measures for the preferred alternative that apply system wide or to specific types of sites and that would achieve the goals of this chapter.
>
> (J) Recommendations for improving the effectiveness of enforcement practices, including, to the extent practicable, the increased use of advanced technology surveillance systems.

Any new, modified or existing marine protected areas will only be effective if their regulations are widely accepted, understood and adhered to by the public. To that end, the first requirement of effective enforcement of restrictions in the network of marine protected areas is education of the public. Where possible, it will also be important to enlist user communities in protecting the designated protected areas. In some contexts, such as specialized fisheries or recreational fishermen allowed access to marine conservation areas, or non-consumptive divers allowed access to marine parks, enlisting those users in enforcement of their protected status will be important.

DFG's enforcement staff is charged with enforcing marine resource management laws and regulations over an area encompassing approximately 1,100 miles of coastline and out to sea for 200 miles. DFG currently deploys 50 law enforcement officers statewide (still well below the staffing level of the 1980's) who focus on the marine environment. Of these 50 officers, 21 are dedicated to on water patrols utilizing patrol vessels as enforcement platforms. DFG has two 65-foot patrol vessels, five new 54-foot vessels and two 40-foot vessels, all of which can patrol wide areas including offshore waters and islands. These large patrol vessels are equipped with 18-foot rigid hull inflatable skiffs. DFG also has 21 skiffs (13-32 feet) for local patrols. Patrol vessels and skiffs are strategically stationed at various ports and other locations to provide the most effective coverage of California's marine waters. DFG also maintains patrol aircraft that are available when needed to assist with marine enforcement activities.

DFG's enforcement program also has cooperative agreements with several federal agencies (National Marine Sanctuary Program and National Marine Fisheries Service) which provide added funds to DFG's enforcement program for operations and personnel dealing with Federal regulations and patrols in Federal waters. These kinds of relationships are likely to continue, and may increase, as other federal agencies enter into similar agreements with DFG. DFG's enforcement program also works closely with the enforcement programs of a number of other governmental agencies (California Department of Parks

and Recreation, National Park Service, U.S. Coast Guard, local harbor patrols and local police and sheriffs departments) on matters of mutual enforcement interest.

Enforcement of current marine protected area regulations is one of many responsibilities forDFG's enforcement program. A new and potentially larger system of marine protected areas is likely to require additional enforcement effort; however, it is uncertain whether significant new sources of funding, personnel and equipment will be available to provide dedicated enforcement for those areas. If additional resources become available, they will most likely provide for increased attention to marine protected areas as part of the overall marine resources enforcement effort.

Regardless of the amount of enforcement funding, personnel or equipment available the enforceability and public acceptance and understanding of marine protected areas will be enhanced if a number of criteria are considered when they are being designed and sited. These criteria are discussed in Section 2 regarding the design of MPAs.

Once marine protected areas have been designed, sited and established, there are a number of strategies that can be followed to increase public acceptance and understanding, and enforcement effectiveness for these areas.

One effective strategy to increase compliance with marine protected area regulations is to make use of other management entities which may have some control of, interest in or presence at the site, or to encourage these entities to include the presence of such an area in their programs. In most cases, marine protected area status is consistent with the mission of these entities and they will view it as an opportunity for their programs. They will often have educational, interpretive and volunteer programs and facilities in place whose purpose is to increase public knowledge of the area's special status. These kinds of programs lend themselves well to communicating information about marine protected areas to the public. Some of these entities will also have their own enforcement staffs that can provide an added frequent on-site presence as well. Formal or informal cooperative agreements between the Department and these entities for enforcement and public information activities may further improve compliance with marine protected area regulations.

Enforcement personnel recommend the use of straight-line boundaries based on latitude/longitude coordinates. These boundaries facilitate enforcement as well as providing clear and understandable edges to the public. Using due north-south and east-west boundary lines allows for simple mapping and display of the areas. Straight lines are preferable to a specified distance offshore or depth contour as they are easier to determine on the water. While determining distance offshore requires the use of radar, which is fairly expensive, and depth contours require the use of sonar, which will vary with the unit's calibration and the tide, latitude/longitude coordinates are easily and accurately measured with global positioning systems (GPS). GPS is not only accurate, but affordable and portable when compared to radar and sonar. Enforcement personnel also recommend that boundaries be based on clear landmarks that are easily defined on maps and seen from the water. In combination, these techniques provide boundaries which are relatively understandable and enforceable.

Another strategy is to use clear and consistent signage and boundary markers at the site that easily communicate that the area has a special status. Marine protected areas with defined access points (parking lots, visitor centers, stairways, etc) lend themselves well to this strategy. Sign design (shape, color, logos) should be unique, easily recognizable and consistent for similar types of marine protected areas. Sign text should be concise and easily convey the level of protection for the site while briefly describing the benefits of increased protection. To further increase public understanding and reduce confusion, the level of protection and its description should be the same for each category or type of marine protected area. For offshore situations, distinctive buoys marking boundary locations might be used where feasible and cost effective.

The use of surveillance and monitoring technologies could play a more important role in the future of marine protected area enforcement. These technologies include the following:

- Vessel monitoring systems (transponders) are already used in a number of areas world-wide to track the location of fishing vessels and ensure that they avoid specific fishery closure areas. This is especially useful for large areas which are remote, far offshore or difficult to observe consistently.

- Night vision equipment is readily available and being used more frequently in marine enforcement activities. Since violators of marine protected area regulations may chose to operate at night in an attempt to avoid detection, this type of equipment could prove very useful in these areas.

- Radar which is linked with global positioning equipment and based on patrol vessels or aircraft can now provide accurate location information for suspected fishing vessels which may be operating in or near marine protected areas. Such accurate position information can greatly strengthen prosecution against those charged with violating marine protected area regulations.

- Remote camera systems may also play a future role in marine protected area surveillance. Locations which have permanent facilities such as service buildings, visitor centers or other structures could provide the infrastructure necessary to support video cameras which could send images directly to monitoring centers or to Internet websites (web cams). Images from such remote cameras could be monitored on a regular or random basis or more intensively if illegal activity is suspected or imminent.

The principal recommendations of this Master Plan Framework regarding enforcement and the use of advanced technology are as follows (not in order of priority):

- Seek additional State resources to support enforcement needs resulting from creation of new and larger marine protected areas. Focus this support on the need for additional staff to monitor activities within MPAs.

- Make use of cooperative efforts and agreements with other agencies interested in marine protected areas to provide increased enforcement presence at those locations.

- Make increased use of current and new technologies to enhance surveillance and enforcement effectiveness in marine protected areas.

- Insure, to the extent practical, that new marine protected areas are designed and sited to maximize simplicity and recognition of boundaries, are observable, are linked to other governmental entities with interests in these areas and are large enough to provide protective buffers around any sensitive habitats or resources.

- Support and encourage the development of local information and education programs designed to increase public understanding and acceptance of marine protected areas as a positive resource management measure.

- Insure that signage and boundary markers, when used, are understandable, recognizable, and provide consistent information for similar areas.

- Include enforcement efforts focusing on marine protected areas as an integral component of the overall marine enforcement program.

Section 5: Monitoring and Evaluation of MPAs

In the last several decades, monitoring and evaluation have become important features of management approaches to living marine resources and the environment (NRC 1990). More recently, they have become central elements in management programs intended to adapt as understanding of the managed ecosystems – both the biophysical and social systems – improves and circumstances change. In California, the Legislature incorporated this adaptive approach into the Marine Life Management Act (MLMA) in 1998. Besides defining adaptive management, the MLMA requires the development of research and monitoring activities within fishery management plans (FGC Sections 90.1, 7073[b]3, and 7081).

A year later, the Legislature incorporated the principle of adaptive management as well as monitoring and evaluation of MPAs and MPA network components into the Marine Life Protection Act (MLPA):

- At FGC Section 2853(c)3, the MLPA requires that the Marine Life Protection Program include "[P]rovisions for monitoring, research, and evaluation at selected sites to facilitate adaptive management of MPAs and ensure that the system meets the goals stated in this chapter."

- FGC Section 2852(a) uses the definition of adaptive management first used in the MLMA: "'Adaptive management,' with regard to marine protected areas, means a management policy that seeks to improve management of biological resources, particularly in areas of scientific uncertainty, by viewing program actions as tools for learning. Actions shall be designed so that, even if they fail, they will provide useful information for future actions, and monitoring and evaluation shall be emphasized so that the interaction of different elements within marine systems may be better understood."

- At FGC Section 2856(a)2(H), the MLPA requires that the Master Plan include "[R]ecommendations for monitoring, research, and evaluation in selected areas of the preferred alternative, including existing and long-established MPAs, to assist in adaptive management of the MPA network, taking into account existing and planned research and evaluation efforts."

- Finally, FGC Section 2855(c)3 requires that in developing the Master Plan, the Department and team solicit comments and information from interested parties regarding a number of issues, including the design of monitoring and evaluation activities.

In these and other ways, the MLPA emphasizes the role of monitoring and evaluation in adapting individual MPAs and MPA network components in response to new knowledge and circumstances. In doing so, the MLPA reflects state of the art practice and expert opinion (NRC 2001). It is worth noting that the MLPA does not call for monitoring and evaluation of all MPAs, but rather of selected areas.

Since MPA network components will be phased in individual regions through 2011 rather than adopted all at once statewide, the initial focus must be on developing effective monitoring programs in individual regions, including monitoring in areas both inside and outside MPAs. As these programs yield results,

experience should lead to the revision of this document for use in later regions. The final phase in developing monitoring and evaluation programs will be the evaluating and adjusting these programs in individual regions to reflect a coherent program statewide.

Meeting the MLPA's standards regarding adaptive management should begin with developing management plans, as described elsewhere, that identify explicit ecological and socioeconomic goals for each MPA and MPA network component that align with the intent of the MLPA. Specific measurable objectives should be identified that can be used to evaluate progress towards these MPA goals.

Clear and measurable objectives should, in turn, form the basis for the design of systems to monitor and evaluate the impacts of management actions. Monitoring and evaluation systems should explicitly address five principles (Pomeroy et al. 2004). Such programs should be:

- Useful to managers and stakeholders for improving MPA management;
- Practical in use and cost;
- Balanced to seek and include scientific input and stakeholder participation;
- Flexible for use at different sites and in varying conditions; and
- Holistic through a focus on both natural and human perspectives.

Adaptive management also requires a feedback loop through which monitoring results inform management decisions. Through this process the MPA network objectives, management plans, and monitoring programs are adjusted in response to new information and circumstances (Pomeroy et al. 2004; NRC 1990). To this end, management plans for MPA network components should specify methods and timing for reporting and incorporating the results of monitoring and evaluation programs into management decisions *before* monitoring programs are developed and implemented.

Effective monitoring and evaluation programs can assess whether actions taken have produced the desired results and other benefits (Pomeroy et al. 2004). For instance, such programs can assess whether resources expended in management have been effective and consistent with policy and management goals, and have yielded progress toward goals and objectives. Appropriately defined benchmarks provide useful quantified measures of progress toward a goal at specified stages. The results from such activities can increase understanding and confidence among stakeholders in existing management measures or the need for changes in management. Monitoring and evaluation can generate the kind of information that decision makers seek when considering requests for additional resources. Well-designed monitoring and evaluation programs also can build understanding about the structure and function of the managed ecosystem, and thereby improve the knowledge base for future management decisions.

Many of the recommendations that follow largely come from a 2004 guidebook to natural and social indicators for evaluating MPA management effectiveness (Pomeroy and others 2004). This discussion relies heavily on this guidebook because it is comprehensive, reflects the experience of MPAs around the world, has been field tested, and relies principally upon techniques that are simple rather than complex, and therefore more likely to be implemented and sustained over the long term.

The discussion below presents only the more general features of the approach presented in the guidebook; much more detail is available in the guidebook itself. In addition, monitoring and evaluation programs should reflect local conditions, constraints, and opportunities.

Developing a Monitoring and Evaluation Program for MPAs and MPA Network Components

To promote consistency among monitoring and evaluation programs in different regions, developers of regional MPA network components should follow the sequential process outlined below. Parallel processes are likely to eventually be undertaken at a statewide level to enable adaptive management of California's system of MPAs and MPA network as a whole. Note that the first step – the clear articulation of goals and measurable objectives – is critical for developing a useful monitoring and evaluation program for an individual MPA or a MPA network component.

The principal steps of the Master Plan Framework process follow. Any departure from this process should be noted and justified.

- Identify MPA goals and objectives.
    - Identify any overlapping goals and objectives.
- Select indicators to evaluate biophysical, socio-economic, and governance patterns and processes
    - Review and prioritize indicators,
    - Develop quantifiable benchmarks of progress on indicators that will measure progress toward goals and objectives, and
    - Identify how selected indicators and benchmarks relate to one another.
- Plan the evaluation.
    - Assess existing data;
    - Assess resource needs for measuring selected indicators;
    - Determine the audiences to receive the evaluation results;
    - Review relevant monitoring and evaluation programs at existing MPAs, such as at the Channel Islands;
    - Identify participants in the evaluation; and
    - Develop a timeline and workplan for the evaluation.
- Review and revise planned monitoring and evaluation program.
    - Conduct structured peer and public review processes, and
    - Make modifications in response to review.
- Implement the evaluation workplan.
    - Select methods and approach and collect data;
    - Manage collected data, includes identifying the data manager, providing for the long-term archiving and access to the data, and making the data available for analysis and sharing;
    - Analyze collected data; and
    - Conduct peer review and independent evaluation to ensure robustness and credibility of results.
- Communicate results and adapt management.
    - Share results with target audiences, and

- Use results to adapt management strategies.

To achieve the purpose of informing adaptive management, the results of monitoring and evaluation must be communicated to decision makers and the public in terms that they can understand and act upon (NRC 1990). Moreover, in addition to aiding in MPA management, measuring, analyzing and communicating indicators can promote learning, sharing of knowledge and better understanding of MPA natural and social systems among scientists, resource managers, stakeholders, members of the public, and other interested parties (Pomeroy et al. 2004). To these ends, monitoring and evaluation programs for MPA network components should include a communications plan that identifies the target audiences and specifies the timing, methods, and resources to regularly synthesize and present monitoring and evaluation results.

The results from monitoring and evaluation should be reviewed annually, although any one year's review may concern a different group of indicators. At a minimum, a comprehensive review of monitoring should be conducted every five years. These reviews should be transparent, include peer review, and make results available to the public. Besides evaluating monitoring methods and results, the review should evaluate whether or not the monitoring results are consistent with the goals and objectives of the MPA network component and the MLPA. If the results are not consistent, the review should develop recommendations for adjustments in the management of the MPA network component.

Within the above set of required components, the Master Plan Framework does not prescribe specific monitoring methods. For example, monitoring and evaluation programs may be effective within a range of levels in intensity and sampling frequencies. They also may rely on different indicators, depending on the MPA goals and objectives. Useful guidance on the selection of indicators can be found in Pomeroy et al. (2004).

General Considerations in Identifying Indicators

An indicator measures the success of a management action, such as the specific design of an MPA. It is a unit of information measured over time that will make it possible to document changes in specific attributes of the MPA (Pomeroy et al. 2004). General considerations in selecting or designing an indicator, include:

- Measurable - able to be recorded and analyzed in quantitative or qualitative terms.
- Precise - clear meaning, with any differences in meaning well understood OR measured the same way by different people.
- Consistent - not changing over time, but always measuring the same thing.
- Sensitive - changing proportionately in response to actual changes in the variables measured.
- Simple - rather than complex.
- Independence defined - correlation with other indicators examined.

The Master Plan Framework requires MPA monitoring and evaluation programs to measure biophysical, socio-economic, and governance indicators, since these dimensions of marine ecosystems are inextricably linked (Pomeroy et al. 2004). Text below provides examples of possible indicators.

Biophysical. One common focus of MPAs is the conservation of the living marine resources and habitats of California's coastal waters. Likely biophysical goals of individual MPA network components established under the MLPA include sustaining the abundance and diversity of marine wildlife, protecting vulnerable species and habitats, and restoring depleted populations and degraded habitats. Thus, potential biophysical indicators might include (Pomeroy et al. 2004):

- Abundance and population structure of species of high ecological or human use value;
- Composition and structure of a community of organisms;
- Survival of young;
- Measures of ecosystem condition;
- Type and level of return on fishing effort;
- Water quality; and
- Areas whose habitat or wildlife populations are showing signs of recovery.

Socio-economic. Socioeconomic indicators make it possible to understand and incorporate the concerns and interests of stakeholders, to determine the impacts of management measures on stakeholders, and to document the value of an MPA to the public and to decision makers (Pomeroy and others 2004).

Possible socio-economic indicators include (Pomeroy et al. 2004):

- Use data (and values of those uses) for consumptive and non-consumptive purposes;
- Level of understanding of human impacts on resources;
- Perceptions of non-market and non-use value;
- Community infrastructure and business;
- Number and nature of markets; and
- Shareholder knowledge of natural history.

Governance. By definition, MPAs are a governance tool since they limit, forbid, or otherwise control how people use marine areas and wildlife through rights and rules (Pomeroy and others 2004). Governance may include enforcement, use rights, and regulations. Goals for governance of MPAs include the following (Pomeroy et al. 2004):

- Legal certainty as indicated by legal challenges or reported failure to act because of legal uncertainty;
- Effective management structures and strategies maintained;
- Effective legal structures and strategies for management maintained;
- Effective stakeholder participation and representation ensured;
- Management plan compliance by resource users enhanced; and
- Resource use conflicts managed and reduced.

Possible governance indicators include the following:

- Local understanding of MPA rules and regulations;
- Availability of MPA administrative resources;
- Existence and activity level of community organizations;
- Level of stakeholder involvement; and
- Clearly defined enforcement procedures.

In selecting indicators, a monitoring and evaluation plan for an MPA or MPA network component should (Pomeroy et al. 2004):

- Define and provide a brief description of the indicator;
- Explain the purpose and rationale for measuring the indicator;
- Consider difficulty and utility—that is, how difficult it is to measure and the relative usefulness of information provided by the indicator;
- Evaluate the required resources including people, equipment, and funding;
- Specify the method and approach to collecting, analyzing, and presenting information on the indicator, including sample size, spatial and temporal variation;
- Identify reference points or benchmarks against which results will be measured and timelines within which changes are expected;
- Explain how results from measuring the indicator can be used to better understand and adaptively manage the MPA;
- Provide references on methods and previous uses of the indicator.

Prior knowledge of the variability in the indicators selected should be incorporated into the monitoring and evaluation design where possible. If no prior knowledge exists variation in indicators must be identified within the monitoring and evaluation program. Multiple independent indicators are required for complex systems such as in the marine environment.

Finally, it is important to recognize the role that volunteer monitoring activities can play in evaluation. For example, the Citizen Watershed Monitoring Network in the Monterey Bay National Marine Sanctuary has used a monitoring protocol developed by the U.S. Environmental Protection Agency in collecting information on water quality in the sanctuary. Information from this program has helped in determining where education and outreach efforts should be targeted how successful specific pollution reduction activities have been, and in identifying problem areas for further investigation.

Section 6. Financing

Achieving the goals and objectives of individual MPAs, the statewide system of MPAs, and of the MLPA itself will depend upon sufficient funding for carrying out key management activities, including public education, research, monitoring and evaluation, and enforcement. At FGC Section 2856(a)2(K), the MLPA requires that the master plan include "[R]ecommendations for funding sources to ensure all MPA management activities are carried out and the Marine Life Protection Program is implemented."[3]

For many types of management activity, including monitoring, public education, and enforcement, estimates of costs will vary depending on the intensity of the activity, which may range between essential or critical levels to optimal levels. As a result, overall costs for carrying out management activities will be a range of estimates for any one year. Estimates and actual costs will also vary from year to year, particularly in the early years of an MPA network component as initial start-up costs are absorbed. An effective management plan will map these potential costs over several years.

Although some funds for management may be raised from local fees or from the private sector profit and non-profit communities, the primary source of funding for the management of MPAs will be state government and perhaps the federal government (Salm et al. 2000). It is also possible to reduce the need for government funding through effective partnerships in carrying out management or research activities. However, such approaches as collaborative research with fishermen and other stakeholders are only now beginning in California and require a significant investment initially, and quite possibly regular investment over the long term.

Funding the management of a statewide MPA network should also be viewed within a broader context that includes the funding of other new and continuing efforts to maintain and enhance the living marine heritage of California, including more recent legislation such as the Marine Life Management Act and other, older legislation on fisheries, coastal and marine habitat, and water quality.

Because available state funds fluctuate with changes in the overall economic health and priorities of California and the Nation, marine and coastal programs of all types have to constantly adjust to these changes.[4] The lack of funds at certain periods is an insufficient reason for inaction. Otherwise, such broadly accepted functions as fisheries management and pollution control would cease in lean times, with ruinous consequences for coastal ecosystems, economies, and communities. Management plans are an important tool for protecting MPA network components and their benefits during times of limited funding. Sound management plans can help ensure that realistic cost estimates are taken into account when such features as boundaries are decided. They also can help prioritize the most vital activities at

[3] The MLPA itself does not define "management activities" but defers the identification of specific management activities to the Master Plan. The logical place for the identification of management activities is the development of a management plan for individual regional MPA networks, as described elsewhere.

[4] Currently, the state budget includes little funding explicitly devoted to implementation of the MLPA. See Endnote 5.1 for a brief history of public and private funding of MLPA activities.

times of low financial resources, and allocate funds efficiently and effectively when more generous funding is available.

Financing an effective system of MPAs in California will depend upon this good planning as well as tapping into a diverse array of non-governmental and governmental funding sources. A detailed approach to doing so awaits adoption of a long-term funding strategy that is being prepared by the MLPA Initiative, as well as the development of management plans for the regional components of the MPA network. In the meantime, this Master Plan Framework can identify some possible candidates for inclusion in a portfolio of funding sources.

Potential funding sources differ in a variety of ways, such as whether they may provide funding in the short- or the long-term, and whether they require changes in authorizing legislation. Some sources derive from fees on user groups while other sources derive from broader groups. The following preliminary list of options present a starting point for the development of the comprehensive funding strategy the MLPA Initiative will produce by December 2005.

Bond Funds: Between 1996 and 2002, Californians voted for five bond measures for natural resources and environmental protection, recreation, and cultural and historical resource preservation, and similar bond measures can be anticipated in the future. The Marine Life Protection Program would be a possible candidate for funds from existing bond funds for water quality monitoring and capital expenditures that support recreation and natural resource protection. Different agencies, including the Coastal Conservancy, Department of Fish and Game, and the State Water Resources Control Board, allocate funds to targeted agency programs and award bond funds on a competitive basis under criteria specific to each bond program. Future bond measures might explicitly call out the Marine Life Protection Program as an approved recipient of bond revenues.

Environmental License Plate Fund: Under the Governor's proposed 2005-2006 budget, a dozen agencies will receive approximately $37 million in funding from the California Environmental License Plate Fund. Of this amount, $15.8 million is earmarked for the California Department of Fish and Game (CDFG) and $1.2 million for the State Coastal Conservancy. The California Ocean Protection Act of 2004 authorized the use of license plate funds for the purposes of the act, including improving "management, conservation, and protection of coastal waters and ocean ecosystems," monitoring and scientific data, and capital investments in monitoring and enforcement systems (PRC Code 35650[b]2[E, F, G]).

Water Pollution Control Funding: AB 2529, which was passed by the Legislature in 2004, authorizes the State Water Resources Control Board to provide grants for projects that "restore and protect the water quality and environment of marine managed areas," including MPAs (PRC Section 30920[a]). Such grants could compliment other measures to protect resources in MPAs.

User and Concession Fees: MPAs in some areas outside the United States have generated funding for management through fees on scuba diving tanks, for instance. Unlike the case of terrestrial parks where access is limited, access to most MPAs is quite open, creating great obstacles to insuring the collection of any fees. Where tank fees have been imposed, for instance, access is limited by a geography very

different from that of California. For instance, in Bonaire, an island off Venezuela, fees for scuba diving in MPAs have been successfully imposed partly because the marine parks are in so isolated and limited a geographical area. When diving and other fees have been suggested as a source of funding of MPAs in the United States, they have been successfully opposed by diving groups, manufacturers, and other stakeholders.

Commercial and recreational fishermen already pay license and other fees dedicated to supporting existing management and conservation of marine fisheries.

Fees from concessions associated with MPAs might also provide a source of funding for MPAs as they do on land. However, there are few examples of such fee programs in the United States or elsewhere.

Mitigation Funds: Large-scale uses of coastal lands and waters sometimes generate funding to mitigate impacts. These sources of funds are highly uncertain, partly because of demands upon them and partly because some activities are still in planning stages or speculative. Such activities include onshore power plants, ocean energy facilities, aquaculture, liquid nitrogen gas facilities, port expansion, decommissioning in place of offshore oil platforms, and desalination plants. Mitigation funding from such projects might support some types of activities in support of the management of MPAs.

Tidelands Oil and Gas Revenues Dedication: Tidelands oil and gas revenues have ranged between $15 million and $225 million annually. Most of these funds are now dedicated to the General Fund. The Legislature does earmark funding above the General Fund allocation to a variety of uses. In recent years, these have included funds for DFG, programs recently including those related to marine life protection and ocean management.

De Minimis Fees and Taxes: Applying very small fees or taxes to a high volume of transactions having some linkage to the use of coastal and ocean resources could generate substantial amounts of funding for their protection and management. One example might be a fee of a few pennies on every recordation of a real estate document in coastal counties. Another is a tax of 10 to 15 cents for every $100 spent per night for lodging in a coastal county. However, most local jurisdictions already impose such hotel "transient occupancy taxes," in most cases paid by non-residents, to generate general revenues or to support marketing efforts. Another idea is to raise the fee on barrels of oil imported to the state by a fraction of a penny, or reallocating a portion of fees currently levied.

Recreational Goods and Services Tax: Assessing an excise tax on goods and services associated with nonconsumptive wildlife recreation have an intuitive appeal, given the phenomenal growth in nonconsumptive forms of wildlife and outdoor recreation and the precedent of excise taxes long levied on products associated with hunting and fishing. However, efforts to implement such taxes have met fierce industry opposition at the national and state level.

Federal Funding: In the last decade, the federal government has actively promoted the establishment of MPA networks, particularly since Executive Order 13158 of May 26, 2000, which called for an expanded comprehensive system of MPAs throughout the country. The MLPA is the only systematic effort to develop such a system of MPAs anywhere in the country in state or federal waters. With this in

mind, the state may seek funding from a variety of federal programs administered by agencies such as the U.S. Department of Commerce, U.S. Department of the Interior and the U.S. Environmental Protection Agency.

Private Sources of Funding: Like the MLPA Initiative, the California Ocean Protection Act (COPA) of 2004 recognizes the importance of drawing upon private and charitable resources in developing ocean protection and conservation strategies (PRC Section 35515[d]). One source of such funding is the private foundation, generally an entity that awards grants from an endowed fund managed by its own trustees. Private foundations may provide infusions of funding at key junctures in a government's efforts to develop MPAs and MPA networks, or for discrete program activities, but typically make grants to other private nonprofit groups, and will not fund ongoing operations or other activities traditionally funded by government. Public foundations may solicit funds from the public and receive funds from private foundation, corporate, and governmental sources and provide direct services or in turn make grants. Creating a California MPA foundation, or expanding the mandate of an existing foundation, would provide a mechanism for attracting and channeling funding to support the MPAs of the Marine Life Protection Program.

Research into the feasibility of these funding mechanisms, and more, will be required to formulate the comprehensive strategy for financing a statewide system of MPAs that the Blue Ribbon Task Force will submit to The Resources Agency in December 2005.

Endnote 6.1. Past Funding of MLPA Activities

Funding Directly Related to the MLPA

- *June 2000*: The David and Lucile Packard Foundation provided a grant of $49,460 to the National Fish and Wildlife Foundation for implementation of the MLPA, mostly travel and per diem costs for scientists attending meetings of the Master Plan Team. This funding was matched by Coastal Impact Assessment Program (CIAP) funds described more fully below. The combined funds support a graduate student assistant to the Master Plan Team, development and maintenance of a web page for public information, and public meetings.

- *2000*: The Legislature appropriated and the Governor approved $2 million for implementation of the Marine Life Management Act and the MLPA. Most of this funding was expended on implementing the MLMA, although some funding provided staff support to the Master Plan Team.

- *2001-2002*: The Resources Agency provided $372,000 in federal CIAP funds to the Department of Fish and Game for MLPA implementation. This funding was directed to support of the public process and for GIS support. It is expected that the GIS support funds will be used in the 2005-2006 fiscal year.

- *2003*: The Resources Agency provided $379,000 in federal CIAP funds for biological and socioeconomic research managed by California Sea Grant in support of implementation of the MLPA. It is expected that funds will be dispersed to specific projects early in 2005.

- *2003*: The Legislature appropriated and the Governor approved $800,000 for fiscal year 2004 implementation of the MLPA. These funds, however, were not sufficient to fully fund the process without significant match from outside sources. Additionally, the funds would have required an equal reduction in funding from other important programs. The final 2003 budget did not include this funding.

- *2004:* The Legislature appropriated and the Governor approved $500,000 for MLPA implementation in fiscal year 2005 and a continuing annual appropriation for following years. Private foundations assembled $7.5 million in funding through 2006.

Related Funding

Since 1997, the Department of Fish and Game and several programs in the National Oceanic and Atmospheric Administration have provided nearly $2 million in funding for strategic habitat mapping in certain areas along the coast. DFG has provided ongoing staff support through general funds to the MLPA process. DFG and several partner groups have provided support for ongoing research and monitoring in existing MPAs to help provide the scientific knowledge necessary for the MLPA.

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